

XXIX.—*Description of a Hybrid Smerinthus, with Remarks on Hybridism in general.* By J. O. WESTWOOD, F.L.S.

[Read 1st January, 1838.]

THE account given by Mr. House in the preceding article, of the production of hybrid specimens by a forced union of *Smerinthus ocellatus* ♂, and *Populi* ♀, is especially entitled to observation, as being the first recorded statement of any satisfactory result arising from such an adulterous marriage, as this unnatural union between two distinct species of insects has been not unaptly termed, in this class of animals.

The following is a precise description of the appearance of one of these hybrids, which, in conjunction with the figure of it, which I beg to offer to the Society, exhibiting the upper and under view of the wings, will give an idea of its peculiar relations to each of its parents. (See Plate XI. fig. 1.)

The two specimens which I have examined would, from the form of the body and the pectination of the antennæ, be regarded as male insects. The expanse of the wings in both is three inches. In the outline of the wings the character is intermediate between the two species, the external margin being nearly similar in its general figure to that of *Ocellatus*, but being notched, although far less strongly, than in *Populi*. The markings of the fore wings are almost identical with *Populi*, the outer margin of the dark discoidal central broad bar is more irregular, and is succeeded by two waved fasciæ, the first of which is less conspicuous than the other. The markings of the hind wings, on the contrary, more nearly resemble *Ocellatus*; the pink colour of the base is however exchanged for the dark ferruginous colour as in *Populi*, extending more generally over the wing than in the latter species. In the place, however, of the beautiful and clearly marked grey, silvery, blue, and black eye of *Ocellatus*, there is a large indistinctly suffused black patch, in which is an obscurely defined dark leaden coloured eyelet. On this pair of wings are no traces of the transverse bars of *Populi*. On the under side the markings of all the wings resemble those of *Ocellatus* more nearly than those of *Populi*, there being four waved fasciæ across the disc of the posterior pair. Moreover the basal half of the fore wings is, as in *Ocellatus*, of the same colour as the base of the hind wings above, being of a dark ferruginous hue, which is far more strongly coloured in one than

in the other specimen. The thorax on the upper side is marked with a large oblong dark mark, but which is neither so dark coloured nor so large as in *Ocellatus*. In *Populi* there is no trace of this mark.

Hence we see, that with the exception of the markings of the anterior wings, there is a far greater tendency to *Ocellatus* (the male parent) than to *Populi* in these hybrids.

In the higher animals the occurrence of hybrids is so frequent as to leave no doubt as to the power of generation between two distinct but allied species of animals: the only question being, whether these hybrids are or are not fertile? a question to be solved only by experiment, and a very careful comparative investigation of the structure of the organs of generation. It is the general opinion that hybrids are not productive, but if, as in the case of the moths under observation, the individuals exhibit all the external characters of one or the other sex, the non-possession of the power of generation must originate in some organic internal deficiency which requires investigation. Instances, it is true, are upon record, of fertile hybrids between the common gander and the Chinese goose (which hybrids had bred between themselves), between the Chinese boar and the common pig, and between two species of geese (*Anas boschus* and *A. acuta*). These instances were mentioned by various naturalists at the Bristol Meeting of the British Association, August, 1836; but they appear to have been considered to have originated in some mistake or oversight. (See Athenæum, 1836, p. 634.)

Mr. Eyton, however, in a more recent communication, published in the Magazine of Natural History for July, 1837, has clearly substantiated some of these, but leaving it in doubt whether or not this fact did not prove that the supposed parent-species ought only to be regarded as varieties rather than species, but leaning to the contrary opinion.

Mr. Eyton has since informed me that he has succeeded in breeding from the hybrids between the common and Chinese geese for three generations.

The same gentleman, on the 12th May, 1835, read some account before the Zoological Society of a hybrid bird, between the cock pheasant, *Phasianus Colchicus*, Linn., and the grey hen, *Tetrao perdix*, Linn., and of which he had made an anatomical investigation. In this instance the specimen, although a female, is expressly stated to have the left oviduct very imperfect, the ovaries very small, the eggs scarcely perceptible and very few in number; the plumage of the bird was also very curious, some parts of it

resembling either sex of both black game and pheasant. It would be very interesting to ascertain whether such a hybrid as this would breed, or whether, unlike the hybrids between the common and Chinese geese, it would be sterile; this information would, in fact, give a further clue to the decision of the question, whether the theory of John Hunter be or be not correct? Still in the vertebrated animals it remains to be proved, after admitting that fertile hybrids may be produced between two closely allied but distinct species, what are the limits to the production of sterile hybrids? Copulation may, from some untoward circumstance or other, take place between two animals widely separated in their natural relations, but there must be some, although yet unascertained, limits to the production of hybrids.

Thus there are already numerous instances on record in which insects of different species, genera and even orders, have been coupled together, and there have been opinions given upon the subject by eminent Entomological physiologists, to each of which it will be interesting to recall the attention of the Society.

In the fourth volume of Germar's *Magazin der Entomologie* (p. 404—409, translated in Silbermann's *Rev. Ent.* No. 3,) an account is given, from the observation of Rossi, (published in the *Memorie della Societa Italiana*, tom. viii. p. 119,) of a connexion between *Telephorus melanurus* ♂ and *Elater niger* ♀; likewise, from the observation of Müller of Odenbach, between *Chrysomela polita* ♂ and *Ch. graminis* ♀, and *Donacia simplex* ♂ and *Apoderus Coryli* ♀.

Treviranus, also, (*Vermischte Schriften*, vol. i. p. 22,) cites Voigt's *Magazin* (f. d. Neusten Zustand der Naturkunde, book ix. st. 3, s. 232) for a similar connexion between a male *Melolontha agricola* and a female of *Cetonia hirta*.

Linnaeus, in the last edition of the "*Systema Naturæ*," p. 587, states, that Müller had observed *Chrysomela graminis* and *Chrysomela ænea* in copulation together, and that he had himself seen *Chrysomela ænea* and *Ch. (Adimonia) alni* similarly situated. Müller, however, in his work on the *Hydrachnæ*, (Introduction, p. xix.) states, that Linnaeus had been mistaken in the former assertion, and that the species which he had thus detected were *Chrysomela ænea* and *alni*. And that he had, moreover, found *Hipparchia jurtina* and *janira* (which at that period were regarded as distinct species, but are now ascertained to be the sexes of the same species) similarly coupled.

Mr. MacLeay also detected a species of *Chrysomela* in connexion with a *Galeruca*. Marsham observed a similar circum-

stance between a *Coccinella* and a *Chrysomela*. And Mr. Yates thus found *Spilosoma erminea* and *lubricipeda* together. The three last named observations were communicated to me by the late Mr. Haworth.

Gistel has also recorded (in the *Isis* for 1827, p. 625, cited in the *Bulletin des Sciences Nat.*, February, 1828) a similar occurrence between two allied species of *Chrysomela*, *Ch. menthæ* and *Ch. polita*, which he is thence induced to consider as the legitimate sexes of one and the same species; but this cannot be the case, as one of these species, *Ch. polita*, is sufficiently common in this country, whilst the other has never been detected.

Mr. Hope stated at the meeting of this Society, on the 4th January, 1836, that a similar occurrence had been observed between *Blaps fatidica* and *Akis reflexa*.

M. le Comte Saint Fargeau communicated to the Académie des Sciences a notice concerning the genus *Volucella*, the species of which appear, according to this author, to have a kind of binary relationship together, not only in the habits of the larvæ, and in the general appearance of the insects, but also in the fact of their being not unfrequently found united together. Thus he exhibited instances of this occurrence between *V. bombylans* and *V. plumata*, "où les deux sexes de ces espèces jouoient un rôle inverse dans cette action," (*Enc. Méth.* x. p. 784). He did not succeed in tracing the result of this occurrence, but he mentions that a specimen which he possessed of a *Volucella*, resembling *V. plumata* in the colour of the anterior part of the body, and *V. bombylans* in the terminal segments of the abdomen, seemed to have been the result of such an union, and to prove the fecundating power of the insects under such circumstances.

In the first volume of the *Annales de la Société Entomologique de France*, various observations are recorded upon the coupling of species hitherto regarded as distinct. Thus, M. Rambur considers that *Sphinx vespertilioides* is a hybrid between *Sph. vespertilio* and *Sph. hippophaes*, and that *Sphinx epilobii* is a hybrid between *Sph. vespertilio* and *Sph. euphorbice*. M. Lefebvre also has recorded the observation of two species of *Tortricidæ*, supposed to be specifically distinct, in the act of copulation, but which he is induced from thence to regard as the legitimate sexes of the same species. The same author also mentioned an observation, communicated to him by Treitschke, in which *Zygcæna filipendulæ* ♀ was found coupled with a yellow variety of *Z. ephialtes* ♂, which had been observed by Treitschke, who was thence induced to regard the red variety of *Z. ephialtes* as the result of this union,

especially as he had not noticed the union between the red and yellow specimens of *Z. cphialtes*, nor between the red *cphialtes* and *filipendulæ*. M. Treitschke had also observed *Saturnia carpini* and *S. spini* coupled, and had procured three caterpillars from the eggs, which (the caterpillars) were very nearly similar to those of *carpini*, but which he did not succeed in rearing.

M. Villiers also, in the same volume, p. 422, mentions that having found *Z. minos* and *filipendulæ* coupled, the female produced eggs, from which larvæ were hatched, which the author placed in the retired part of a forest where he had never observed any *Zygæne*, and in the hopes of finding the progeny in the following year, at which time however he found many specimens, but all proved to be *Z. filipendulæ*. These he nevertheless considered to be the result of the observation of the preceding year, although it is evident that no decided opinion could be given upon the circumstance.

M. Stein also, in Oken's *Isis* for 1835, p. 343, has described a bastard butterfly as he regards it, which he had captured, and which he considered to be the production of an union between *Hipparchia Pamphilus* and *Iphis*.

M. Boksch communicated to the Natural History Section of the German Meeting of Naturalists, held at Breslau in 1833, an instance in which *Meloutha hippocastaneus* and *M. vulgaris* had been found coupled. (Trans. Ent. Soc. vol. i. p. iv.)

In the Transactions of our Society (vol. i. Journal of Proceedings, p. 83) instances are mentioned, on the authority of Mr. Shuckard, of specimens of *Osmia* and *Chclostoma* thus found united; and, on the authority of Mr. Hope, of a *Donacia* and *Crioceris*, and of a *Buprestis* and *Elater*; whilst we were assured at the same meeting, by Mr. Scales, of his having observed an attempted copulation between one of the small dragon flies and a *Vanessa urticæ*.

Still more recently Mr. H. Doubleday has noticed the singular occurrence of a copulation between a male *Sphinx ligustri* and a female *Smerinthus ocellatus*, although there were several other individuals of both sexes of the two species at the same time in the breeding cage. (Entomologist, August, 1842, p. 357.)

Such are all the facts which I have been able to discover on record relative to this curious subject. We will, therefore, now notice the opinions which have been given by various Entomological physiologists relative to it, and which not only affect the physiological question of the generative powers of these insects, but also the nature of the claims of many insects, hitherto re-

garded as distinct species, to be considered as such. The celebrated physiologist, Spallanzani, in 1768, published a Memoir, containing suggestions for the instituting of experiments for the production of hybrid insects, with a view of solving the grand problem of generation, which at that period attracted a great share of attention amongst philosophers. His memoir is entitled "Invito a intraprendere sperienze, onde averre muletti nel popolo degl' insetti per tentar di scogliere il gran problema della generazione." A copy of this scarce tract is in the library of the British Museum.

Burmeister (Manual, p. 515) observes, that "it is uncertain whether such mixtures as those detailed above have been productive, but from analogy with the superior animals we might say no; should, however, the copulation of closely allied species actually produce young, these would not be able to unite productively, as is proved by the general rule of analogous instances in the superior animals, yet this, even, is not without an exception. Hence, Gravenhorst's opinion, that from such bastard copulations of allied species many new forms originate, must be totally rejected, exclusive of the view that in case of such a course in nature its beautiful regularity and order would speedily terminate in illimitable confusion, of which, however, there is not the least proof." Now the circumstances recorded by Mr. House enable us to see the extent to which these observations of Dr. Burmeister are applicable. We thus perceive that the copulation of two distinct species of insects is productive—and not abortive—that the progeny of such an union, between two closely allied species, partakes of the specific characters of both species, but that the sexual power is rendered obsolete, and that it is not, except by some rare accident against nature, that such an union takes place. Marsham, however, observes, in the *Entomologia Britannica* (p. 169), "Ex coitu *Coccinellarum* inter omnes familias promiscuo, varietates plurimas ortæ sunt;" whilst M. Boisduval, on the other hand, in his *Monograph* in the *Zygænidæ* (p. 5), states, that he had often found *Zygæna filipendulæ* in copula with *Z. peucedani*, and *Zygæna trifolii* with *Hippocrepidis*, that the females had subsequently laid eggs, but these had never hatched, (a circumstance contrary to the observation of M. De Villiers, cited above). He adds, however, "il est possible cependant que quelques uns éclosent dans la nature." In like manner M. Audouin instituted various experiments upon *Coccinella bipunctata* and *C. dispar*, which are often found coupled, but the eggs produced by the female have always proved sterile, a circumstance which he had noticed as many as